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ABSTRACT

Presented are data from the annual survey of enrollments and degrees of the American Institute of Physics. Nearly 100 percent of the 808 degree-granting physics and astronomy departments responded. Figures and tables provide, with some narration, these data: number of institutions granting bachelor's, master's and doctoral degrees, 1975-76 through 1979-80; bachelor's and master's physics degrees awarded by academic year, 1968-79; enrollments and degrees awarded, by level, 1968-80; undergraduate and graduate enrollments and degrees by institution type, 1968-80; introductory physics enrollments in physics-degree-granting institutions by geographic region, 1975-80; introductory physics enrollments; by major, 1979-80; actual and projected number of undergraduate physics majors, classes of 1980-83; under-graduate physics majors by geographic region and institution type, 1979-80; full-time and part-time graduate physics enrollment by institution type, 1973-80; doctorate-granting institutions reporting unfilled assistantships for first-year graduate physics students, September 1979; actual and projected physics doctorates granted 1968-84; degrees by type of institution and geographic region, 1978-79; degrees granted by sex and minority group status, 1978-79; trend in astronomy degrees granted, 1973-79; astronomy enrollments 1979-80 and degrees 1978-79 in separate and combined departments; and astronomy enrollments 1979-80 and degrees 1978-79 by institution type. (MSE)

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AIP report MANPOWER STATISTICS DIVISION

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ENROLLMENTS AND DEGREES

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by Susanne D. Ellis

March 1980

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As the decade of the 1970's ends, total physics enrollments and degrees appear to have leveled off, and students redistributed themselves among a decreasing number of available physics programs. The large universities have tried to maintain their graduate enrollments by admitting more foreign students, while the 4-year colleges registered a 10% increase in physics majors in one year.

At the beginning of the academic year 1979–80 the total number of institutions granting physics, and or, astronomy degrees was 763. These institutions included those with two physics departments, those with separate physics and astronomy departments, and those with combined physics and astronomy departments. **Table I** presents the changing number of institutions for the past five years, and classifies them by highest physics degree offered.

Table I. Institutions by highest physics degree offered, 1975–80.

Academic year	Doctorate granting	Master's granting	Bachelor's granting est.
1975–76	171	116	524
1976–77	173	114	515
1977–78	172	110	506
1978–79	170*	104	502
1979–80	166*	96	501

* *Five of these institutions have two physics doctorate-granting departments; the second one is generally an applied physics department. They are Stanford U., U. of CA-Davis, U. of CA-San Diego, Harvard U. and Cornell U.*

The annual Survey of Enrollments and Degrees enters its third decade this year and has the distinction of summarizing the data of nearly 100% of the 808 degree-granting physics and astronomy departments. The trends that can be observed in **Figure I** start with the largest class of physics bachelors, the class of 1969, and clearly indicate the leveling in recent years of all degrees: bachelor's degrees just under 4500, master's degrees above 1400 and doctorates around 1000. The numerical data for **Figure I** are presented as part of **Table II** which also includes undergraduate and graduate physics enrollments. By expanding **Table II** to distinguish between the three types of physics departments, one generates **Table III**.

Fig. I. Physics degrees awarded by academic year 1968–79

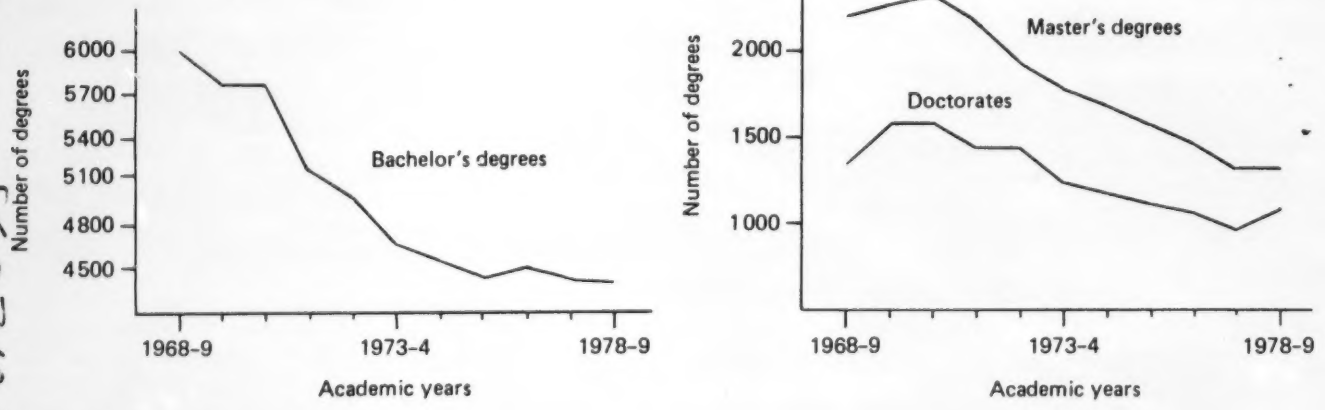


Table II. Physics enrollments and degrees awarded by academic year 1968–80.

Academic year	Number of physics degrees granted (July 1 to June 30)			Undergraduate physics-major enrollment		Graduate physics-student enrollment	
	Bachelor's	Master's	Doctorate	Juniors	Seniors	Total	1st year*
1968–69	5975	2223	1355	7587	7019	15475	3669
1969–70	5782	2268	1545	7480	6700	14372	3918
1970–71	5755	2300	1530	6884	6663	14327	3494
1971–72	5282	2143	1438	659.	6162	13276	3336
1972–73	4923	1961	1445	6012	5806	11804	2904
1973–74	4652	1772	1236	5858	5108†	11119	2680
1974–75	4571	1650	1167	5660	4909†	10410	2668
1975–76	4487	1570	1111	5888	4922†	10372	2646
1976–77	4517	1469	1051	5711	4930†	9981	2624
1977–78	4457	1422	971	5820	4975††	9835	2499
1978–79	4416	1428	1033	5835	4964	9813	2458
1979–80				5696	4942	9647	2439

* *Includes part-time students who might be at the 1st-year level for more than one year.*

† *This total has been adjusted by 500 for students who are seniors for more than one year.*

†† *This total has been adjusted by 300 students who are seniors for more than one year.*

Table III. Undergraduate and graduate enrollments and degrees by institution type, 1968–80.

Academic year	Number of physics degrees granted (July 1 to June 30)			Undergraduate physics-major enrollment		Graduate physics-student enrollment	
	Bachelor's	Master's	Doctorate	Juniors	Seniors	Total	1st year
				Doctorate granting institutions			
1968–69	2994	1850	1355	3794	3699	13633	2998
1969–70	3036	1804	1545	3869	3369	12779	3202
1970–71	2868	1817	1530	3510	3490	12400	2658
1971–72	2502	1640	1438	3082	2987	11434	2449
1972–73	2265	1484	1445	2787	2717	10227	2177
1973–74	2155	1387	1236	2844	2484	9759	2169
1974–75	2191	1318	1167	2780	2420	9295	2205
1975–76	2182	1249	1111	2983	2505	9241	2163
1976–77	2184	1186	1051	2862	2502	8867	2182
1977–78	2218	1164	971	2851	2590	8852	2138
1978–79	2158	1183	1033	2937	2579	8864	2107
1979–80				2696	2491	8744	2072
				Master's granting institutions			
1968–69	1029	373		1335	1270	1842	671
1969–70	1022	464		1281	1274	1593	716
1970–71	1044	483		1220	1175	1927	836
1971–72	982	503		1238	1210	1842	887
1972–73	820	477		1145	1086	1577	727
1973–74	810	385		939	893	1360	511
1974–75	699	332		881	741	1115	463
1975–76	604	321		916	811	1131	483
1976–77	658	283		840	761	1078	442
1977–78	590	258		832	752	983	361
1978–79	541	245		795	694	949	351
1979–80				705	650	903	367
				Bachelor's granting institutions			
1968–69	1952			2458	2050		
1969–70	1724			2330	2057		
1970–71	1843			2154	1998		
1971–72	1798			2273	1965		
1972–73	1838			2080	2003		
1973–74	1687			2075	1731		
1974–75	1681			1999	1748		
1975–76	1701			1989	1606		
1976–77	1675			2009	1667		
1977–78	1649			2137	1633		
1978–79	1717			2103	1691		
1979–80				2295	1801		

Table IV. Introductory physics enrollments in physics-degree-granting institutions by geographic region 1975–80

Geographic region †	1975–76	1976–77	1977–78	1978–79	1979–80
New England	22125	23139	28847	21228	18797
Mid. Atlantic	47861	44919	44839	42652	41555
E.N. Central	52412	50123	51598	50434	50843
W.N. Central	21406	22018	22253	21115	21805
S. Atlantic	37014	36272	38519	33097	33966
E.S. Central	14643	14900	15003	14835	14829
W.S. Central	30089	32956	29968	26768	28563
Mountain	18716	18786	20490	19342	20753
Pacific	34252	34628	32635	32084	31318
Total	278518	277741	284152	261555	262429

†New England—*Conn., Me., Mass., N. Hamp., R.I., Vt.;* Middle Atlantic—*N.J., N.Y., Pa.;* East North Central—*Ill., Ind., Mich., Ohio, Wisc.,* West North Central—*Iowa, Kansas, Minn., Mo., Nebr., N. Dak., S. Dak.;* South Atlantic—*Del., D.C., Fla., Ga., Md., N.C., S.C., Va., W.Va.;*East South Central—*Ala., Ky., Miss., Tenn.;* West South Central—*Ark., La., Okla., Tex.;* Mountain—*Ariz., Colo., Idaho, Mont., Nev., N. Mex., Utah, Wyo.;* Pacific—*Alas., Cal., Hawaii, Oreg., Wash.*

The analysis by type of institution indicates a significant change from earlier years. While institutions with graduate physics departments are registering new lows among undergraduate physics majors, the 4-year physics institutions recorded the largest number of junior physics majors in ten years.

The first-year graduate students shown in the last column of **Tables II** and **III** changed by less than 1% for the total, however, 30% of those 2439 graduate students are foreign students, an increase from 25% in earlier years. It is important to call attention to the first-year graduate enrollment at the doctorate-granting institutions and how relatively constant it remained since 1972–73; these totals are used in projecting the number of physics doctorates granted five years later.

Having presented a comprehensive summary of physics enrollments in the first three tables of this report, **Tables IV** through **X** focus on a detailed analysis of the physics pipeline.

When compared with other disciplines such as chemistry, engineering or the social sciences, physics attracts a relatively small number of majors. Introductory physics, on the other hand, is frequently a required course for engineering or health-related majors and thus enrolls over a quarter of a million freshman-sophomore level students.

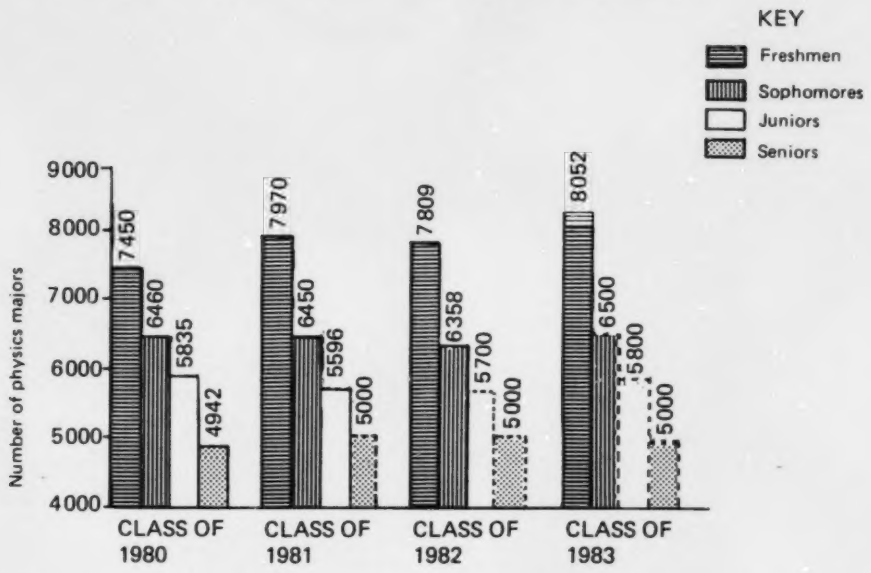
Table IV shows a five-year enrollment trend for each of nine geographic regions which appears to level off just above 260,000. The more detailed analysis of the 1979–80 introductory enrollments is presented in **Table V** where prospective engineering majors at non-PhD-granting institutions register the largest percentage increases from the previous year. The recent greater demand for bachelor's level engineers probably accounts for these changes.

Table V. Introductory physics enrollments 1979–80

Enrollment in introductory physics courses designed for:		Institution type* I		II		III		Total	
		N	%	N	%	N	%	N	%
engineering majors		18689	28.6	12923	33.5	60708	38.3	92320	35.2
physical science majors		13526	20.7	5362	13.9	29007	18.3	47895	18.3
biology, health-related majors		20649	31.6	10918	28.3	44857	28.3	76424	29.1
others		12481	19.1	9374	24.3	23935	15.1	45790	17.4
Total introductory enrollment	N	65345		38577		158507		262429	
	%	24.9%		14.7%		60.4%			100%

* *"Institution type" indicates the highest degree offered; type I = bachelor's degree, type II = master's degree, type III = doctorate.*

Fig. II. Actual and projected number of undergraduate physics majors



Note: Each cluster of four bars shown in **Figure II** *depict the freshmen, sophomores, juniors and seniors of four successive graduating classes. The most recent estimate of freshman physics majors is that for 1979–80 and added up to 8052. Based on the attrition of earlier classes, 5000 of them are expected to become seniors in 1982–83 and are presented above as the "class of 1983".*

With an increasing number of chairmen providing estimates of their prospective physics majors, it is possible to compute the attrition rates that occur in four years of undergraduate study. Thus the first set of bars in **Figure II** follows the 1976–77 freshman physics majors through four years of undergraduate study to become the graduating class of 1980 physics bachelors. As the bargraph of **Figure II** shows there is little variation in the number of freshmen who consider majoring in physics; consequently the number of seniors derived from each group, is expected to remain at 5000 a total which has not changed for almost a decade.

Table VI. Undergraduate physics majors by geographic region and type of institution, 1979–80

Geographic region*	Estimated** no. of freshmen	Estimated** no. of sophomores	Number of juniors	Number of seniors	Fifth-year undergraduates
New England	652	598	545	516	23
Mid. Atlantic	1419	1133	983	830	71
E.N. Central	1416	1086	855	805	54
W.N. Central	599	487	429	367	21
S. Atlantic	1159	906	731	619	54
E.S. Central	379	303	237	179	27
W.S Central	826	593	559	458	30
Mountain	548	393	349	371	44
Pacific	1054	859	908	797	199
Total	8052	6358	5596	4942	523
Doctorate-granting inst.	3602	2924	2696	2491	256
Master's-granting inst.	991	758	705	650	91
Bachelor's-granting inst.	3459	2676	2295	1801	176

* *See Table IV for explanation of geographic region.*
** *Estimates of potential physics majors made by the physics department chairmen.*

Table VII. Full-time and part-time graduate physics enrollment by type of institution 1973–80.

Academic year	Number of first-year graduate students			Total number of graduate students						
	Institution type*			Institution type*						
	II	III	Total	II			III			
				Full-time	Part-time	Sub-total	Full-time	Part-time	Sub-total	Total
1973–74	511	2169	2680	734	626	1360	8810	949	9759	11119
1974–75	463	2205	2668	623	492	1115	8326	969	9295	10410
1975–76	483	2163	2646	628	503	1131	8439	802	9241	10372
1976–77	442	2182	2624	576	507	1083	8119	789	8908	9991
1977–78	361	2138	2499	546	437	983	8174	678	8852	9835
1978–79	351	2107	2458	468	481	949	8185	679	8864	9813
1979–80	367	2072	2439	550	353	903	8059	685	8744	9647

Institution type indicates the highest physics degree offered: type II = master's degree, type III = doctorate.

Although most physics departments do not require their undergraduates to declare a major until the beginning of the junior year, the large number of courses required to major in physics make an early decision practical. Thus chairmen are in a position to supply estimates of freshman and sophomore level physics majors summarized in **Table VI.**

In recent years the number of seniors appeared to be disproportionately large when compared with the number of students receiving bachelor's degrees at the end of each year. Several checks disclosed that some undergraduates remain seniors for more than one year to complete all the requirements for the bachelor's degree. By asking chairmen to separate the number of fifth-year undergraduates from the others, we avoided counting one-tenth of the seniors twice. The last column in **Table VI** shows how these 523 fifth-year seniors distributed themselves geographically and by type of institution.

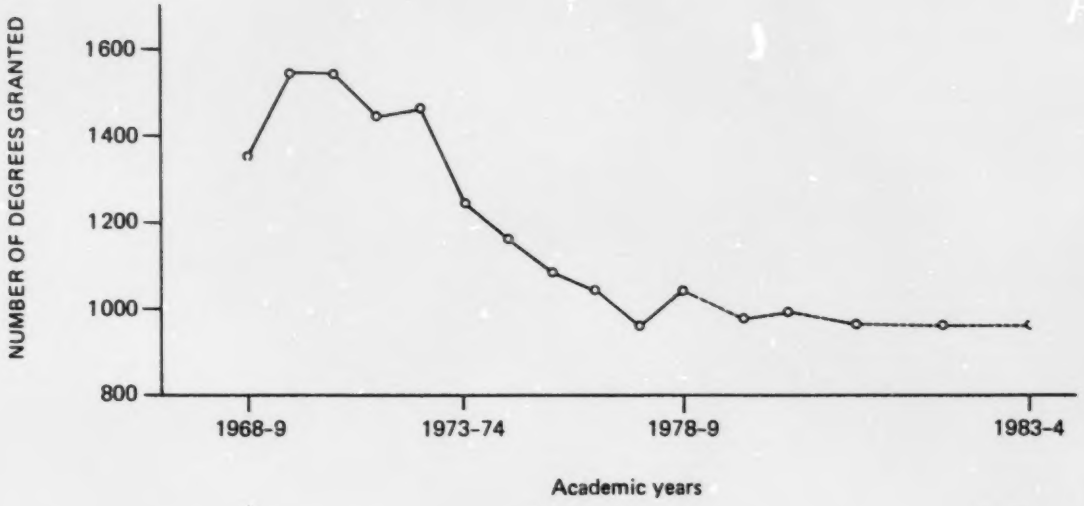
When comparing disciplines of graduate study, a higher proportion of physics students are assured of financial support and study on a full-time basis. The proportions for the latter can be calculated from the data shown in **Table VII**, while **Table VIII** addresses itself to an overabundance of sources of support for first-year graduate physics students. The distribution of unfilled assistantships was by no means uniform throughout the U.S., and ranged from 2% for the Pacific region's first-year students to 50% for the East South Central region. As many as ten institutions in seven different regions of the U.S. each reported six or more unfilled assistantships. The question of unfilled assistantships for first-year graduate students was added to the questionnaire in response to concerns expressed by physics department chairmen.

Table VIII. Doctorate-granting institutions reporting unfilled assistantships for first-year graduate physics students, September 1979

Geographic region*	No. of unfilled assistantships				Approximate no. of unfilled assistantships	No. of 1st yr. grad. students
	None	1–2	3–5	>6		
New England	11	4	2	0	15	248
Mid. Atlantic	17	5	5	2	40	401
E.N. Central	11	1	4	1	25	347
W.N. Central	5	2	3	1	20	92
S. Atlantic	12	4	4	0	20	227
E.S. Central	3	2	4	1	26	50
W.S. Central	8	2	1	2	20	127
Mountain	8	3	0	2	18	135
Pacific	14	1	0	1	8	445
Total no. of institutions reporting	89	24	23	10	192	2072

* *See Table IV for explanation of geographic region.*
Note: 20 institutions did not answer the question on unfilled assistantships.

Fig. III. Actual and projected number of physics doctorates granted 1968–1984.



The median number of years of graduate study to complete a physics doctorate is five, with a range from three to more than ten years. As mentioned in connection with **Table III**, the number of physics doctorates granted each year correlates well with the number of first-year graduate students enrolled at PhD-granting institutions five years earlier. Also, as the number of first-year students decreased, a larger percentage of them eventually received doctorates. Back in the mid-1960's when there were 3500 first-year graduate students less than 40% of them completed their doctoral studies. The total first-year graduate students from which the 1979 doctorate recipients were drawn was 2205, thus 47% of them were granted doctorates. The flat projected portion of **Figure III** reflects the known leveling of the first-year graduate enrollment.

Table IX offers details of where physics degrees are granted and by what types of institutions. Unlike the trend tables at the beginning of this report, **Table IX** distinguishes between degree recipients who enter the job market with a master's degree and those who are granted master's degrees enroute to higher degrees. While one would expect the latter group to be enrolled at PhD-granting institutions, there exists a small number of masters (62 in the class of 1979) who transfer from master's institutions to larger universities and continue their studies toward a PhD. It may be of interest to note that terminal master's degrees declined more rapidly than master's degrees enroute to higher degrees in the 1970's, (a decline of 47% for the former compared with 28% for the latter, since 1971).

Table IX. Physics degrees by type of institution and geographic region, 1978–79.

Geographic region*	Bachelor's degrees			Master's degrees		Terminal master's degrees		Doctorates
	Institution type**			Institution type**		Institution type**		Institution type**
	I	II	III	II	III	II	III	III
New England	155	15	409	0	78	0	61	151
Mid. Atlantic	368	46	413	3	153	19	78	221
E.N. Central	306	181	254	10	121	68	114	189
W.N. Central	177	40	101	4	22	19	22	38
S. Atlantic	260	53	263	12	70	23	56	120
E.S. Central	79	37	47	1	14	7	15	10
W.S. Central	133	64	133	7	45	18	16	70
Mountain	55	12	184	1	32	2	38	47
Pacific	184	93	354	24	178	27	70	187
Subtotal	1717	541	2158	62	713	183	470	1033
				775		653		
Total		4416			1428			1033

* *See Table IV for explanation of geographic region.*

** *Institution type indicates the highest physics degree offered; type I = bachelor's degree, type II = master's degree, type III = doctorate.*

Table X. Number of physics degrees granted by sex and minority group status, 1978–79.

Type of degree	Sex	Total no. of degrees	Minority groups								Total Minorities
			Blacks	Am. Ind.	Puerto Rican	Mex. Am.	Other Latin Am.	Asian Ind.	Oriental	Arab	
Bachelor's	Men	3948	85	6	3	11	16	9	56	16	202
	Women	468	13	1	1	0	2	2	7	2	28
	Total	4416	98	7	4	11	18	11	63	18	230
Master's enroute	Men	696	11	0	0	0	1	16	33	5	65
	Women	79	0	0	0	0	1	3	9	0	13
	Total	775	11	0	0	0	2	19	42	5	79
Terminal master's	Men	591	10	0	1	5	5	7	23	8	59
	Women	62	0	1	0	0	0	4	9	1	15
	Total	653	10	1	1	5	5	11	32	9	74
Doctorate	Men	967	10	0	3	1	7	33	53	3	110
	Women	66	0	0	0	0	0	6	8	0	14
	Total	1033	10	0	3	1	7	39	61	3	124

Sources: "1978–79 Survey of Physics and Astronomy Bachelor's Degree Recipients" AIP Pub. No. R-211.11

"1978–79 Graduate Student Survey" AIP Pub. No. R-207.12

A frequent request for information is the one dealing with the proportion of women and minorities among physics degree recipients. While department chairmen contribute some of these data, a large proportion of **Table X** is based on reports from individual graduates. The table identifies eight minority groups, the members of which received physics degrees in 1978–79. The last four of the eight groups listed include mostly foreign citizens some of whom return to their native countries. Noticeable among the minority groups is the higher proportion of women.

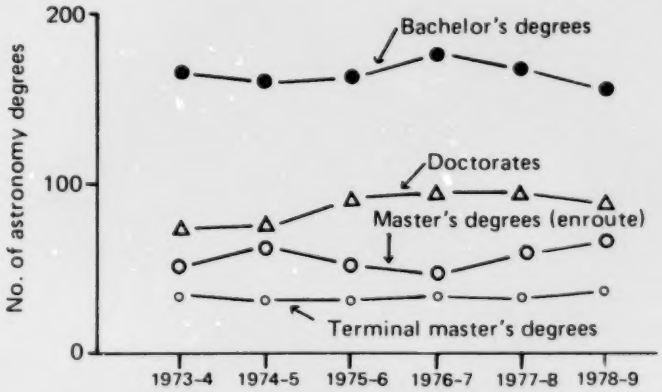
ASTRONOMY

Six years ago the scope of the Survey of Enrollments and Degrees was extended to include astronomy data. The total number of degree-granting astronomy departments is 70 for the academic year 1979–80; included in that total are two groups of doctorate-granting astronomy departments: eleven which are combined with physics departments in addition to 27 that function separately. For the first four years of this survey only 56 degree-granting astronomy departments contributed information consistently, while the other 20 or 25 departments responded only some of the time. In 1978 we made a thorough classification of all astronomy departments to determine the total number for that year and the highest astronomy degree granted by each.

The astronomy degree production shown in **Figure IV** presents estimated totals based on the 56 consistent reporters for the period 1973 to 1977; from 1978 on the data are based on responses from 100% of the departments.

Examining the trends shown in **Figure IV** all master's degrees appear to increase, especially those granted enroute to a higher degree. One factor that contributed to the slight decline in astronomy doctorates for the class of 1979 is a reclassification of doctorates by a few departments. The U. of Iowa for example gives only physics doctorates, even if the candidate's dissertation is in astronomy; consequently its doctorates were reclassified as physics. Other changes

Fig. IV Trend in astronomy degrees granted, 1973–79



included Michigan State U. and the U. of Oklahoma. The upper portions of **Tables XI** and **XII** deal with types of astronomy departments and the highest astronomy degrees they grant. Both tables present the same totals but **Table XII** analyzes the degree production with respect to sex; when compared with the previous year, a larger proportion of the astronomy degrees at all levels are conferred on women.

A supplement to this report offers a complete listing of all 70 astronomy departments with enrollment and degree data specified for each.

Table XI. Astronomy enrollments 1979–80 and degrees 1978–79 in separate and combined departments.

			39 separate astronomy departments	31 combined astronomy and physics departments	70 astronomy departments
	1978–79 ASTRONOMY DEGREES				
	Bachelor's		114	51	165
	Master's		67	6	73
	Terminal master's		35	7	42
	Doctor's		74	12	86
	1979–80 ASTRONOMY ENROLLMENTS				
Introductory courses	for science majors		1834	602	2436
	for nonscience majors		32668	5946	38614
	Subtotal		34502	6548	41050
	Astronomy offered in physics departments		-	-	60620
	Total introductory enrollment				101670
	Juniors		171	68	239
	Seniors		179	63	242
Graduate students	First-year	U.S.	117	19	136
		Foreign	18	0	18
		Total	135	19	154
	Total graduate students	Full-time	566	89	655
		Part-time	36	7	43
		Total	602	96	698

Table XII. Astronomy[+] enrollments 1979–80 and degrees 1978–79 by type of institution[*]

		Type I		Type II		Type III		Total	
No. of departments	Combined	16		4		11		31	
	Separate	5		4		30		39	
	Total	21		8		41		70	
		Men	Women	Men	Women	Men	Women	Men	Women
Astronomy degrees	Bachelor's	25	3	14	6	99	18	138	27
	Master's	-	-	5	0	57	11	62	11
	Terminal master's	-	-	8	1	30	3	38	4
	Doctor's	-	-	-	-	80	6	80	6
Astronomy enrollments 1979–80	Introd. courses for science majors	359		281		1796		2436	
	introd. courses for nonscience majors	4220		1242		33152		38614	
	introd. courses offered in physics departments	-		-		-		60620	
	Total introductory enrollments							101670	
	Junior astronomy majors	49		31		159		239	
	Senior astronomy majors	56		37		149		242	
	First-year graduate students	-		14		140		154	
	Total graduate students	-		43		655		698	

+ *This survey includes only degree-granting astronomy departments*

* *"institution type" indicates the highest astronomy degree offered; type I = bachelor's degree, type II = master's degree, type III = doctorate.*